

ART. II.—*The Age of the Ironstone Beds of the Mornington Peninsula, as adduced from the Marine Fauna.\**

By FREDERICK CHAPMAN, A.L.S., F.R.M.S.

(Palaeontologist to the National Museum, and Lecturer on Palaeontology,  
Melbourne University.)

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**The Related Tertiary Beds.**

This peninsula is bounded on the west by Port Phillip Bay and on the east by Western Port. Owing to the dissection of this area by faulting, and also through the complication of its earlier structural features by local flows of basalt of the Older Period, which partially obscures an undeveloped river system of Miocene times, the geological succession of the various Tertiary beds are here difficult to make out in true detail.

As regards the position of the Grice's Creek and Balcombe Bay fossiliferous marine marls, these fall into line with beds in other areas, as at Muddy Creek (lower series) and the lower beds in the Altona Bay coal-shaft and the Sorrento Bore, all of which are of Oligocene (Balcombian) age, and therefore are at the base of the Tertiary system as developed in south-eastern Australia.

But between these Balcombian and the Kalimnan beds of the peninsula there should occur a series representative of the great diastrophic movements on sea and land during the Miocene period. The question arises: Have these beds been recognised? In reply to this it may be remarked that geologists have for many years been feeling their way to some kind of conclusion which has a more or less direct reference to the subject matter of this note, without reaching a definite conclusion—hence this present attempt.

**Earlier References to the Intermediate Series.**

A. E. Kitson (1900), in his "Report on the Coastline and Adjacent Country between Frankston, Mornington and Dromana,"<sup>1</sup> shows, in his accompanying map, the widely spread

\* Read at the Hobart Meeting of the Aust. Assoc. Adv. Sc., held in Melbourne, Jan., 1921.

1. Monthly Progress Rep. Geol. Surv. Vict., N.S. No. 12, 1900, p. 12.

nature of the deposit of ferruginous grits, sands and clays, to which the fossiliferous ironstone undoubtedly belongs. He remarks upon them as follows:—

“Eocene(?).—Forming the surface along the coast-line from Frankston to a little below the mouth of Chechingurk Creek, and extending far into the country at the back are thick deposits of fine and coarse ferruginous and non-ferruginous sands, quartz grits and clays. On the coast they show in high and low cliffs and sloping banks, extend well up the flanks of the granite and Silurian<sup>2</sup> areas of Mounts Eliza and Martha, and stretch far out across the less elevated portions of the district.”

“Until the fossils from the new beds herein mentioned, or other beds that may yet be discovered, are thoroughly examined and worked out, it is impossible to say definitely if all these strata are Eocene; but, lithologically and stratigraphically considered, the ferruginous and other beds overlying the fossiliferous Eocene clays may reasonably be referred to a much earlier period than the Pliocene, the age to which they have hitherto been assigned by the Survey.”

“In some places there appears to be a distinct unconformity between these ferruginous beds and the fossiliferous clays, and in others no such break is noticeable with certainty. . . . They probably belong to the same series that extends along the coast northwards through Beaumaris and Brighton to Melbourne, and which, on the evidence of the Beaumaris beds, are regarded by Messrs. Tate and Dennant as of Oligocene age, and by Messrs. Hall and Pritchard as of Miocene age.” . . .

“The determination of the casts of fossils, which no doubt exist in many other places besides those noticed, will probably prove of more material assistance eventually in this respect than any attempt made on stratigraphical evidence.”

In the light of later discoveries of fossils, mentioned in the sequel, not only from Landslip Point, but also from Watson's Creek, near Baxter, and which was to some extent predicted and their value as horizon determinants emphasised as above, by Mr. Kitson, the “(?)Eocene” is now relegated to the Miocene or Janjukian.

The deposition of these beds against sloping banks and sometimes at angles up to 10° seems to point to shore or marine littoral conditions. That these ferruginous beds are older than

2. =Lower Ordovician.

the Beaumaris and Brighton series is proved by the faunal aspect of the fossil casts; and so they underlie the Kalimnan to the north.

Kitson's observations as to the ferruginous beds invariably overlying the fossiliferous clays (Balcombian) are valuable, as that alone fixes their approximate position in the Tertiary series. And lastly, the prediction that fossil evidence rather than the stratigraphical may settle the vexed question as to age and succession can be regarded as prophetic.

T. S. Hall and G. B. Pritchard (1901) in their paper on "Some Sections Illustrating Geological Structure of the Country about Mornington"<sup>3</sup> refer to the ferruginous grits as follows:—

"Ferruginous sands and clays mantle over a great part of the area, and their age is shown to be Eocene<sup>4</sup> by the fossils obtained at Landslip Point. It is, of course, quite within the bounds of possibility that further investigation may show that some of the beds are younger than this; but, in the meantime, we seem justified in referring the ferruginous grits of the district all to the one age."

An interesting point is here revealed, inasmuch as the above authors, believing that some of the ferruginous beds may be younger than the "Eocene," thus gave additional proof, now that they prove to be Janjukian, from field evidence, that the Janjukian overlies the Balcombian, since the ferruginous grits and accompanying fossils are superposed on the Balcombian marls.

Messrs. Hall and Pritchard also furnished a list of fossils from Landslip Point, Frankston, which is as follows<sup>5</sup>:—

*Placunanomia sella*, Tate; *Pecten dichotomalis*, Tate; *Amusium zitteli*, Hutton sp.; *Lima bassi*, T. Woods; *L. linguliformis*, Tate; *Spondylus pseudoradula*, McCoy; *Septifer fenestratus*, Tate; *Nucula obliqua*, Lamarck; *Leda vagans*, Tate; *Glycimeris maccoyi*, Johnston sp.; *Arca (Barbatia) celleporacea*, Tate sp.; *Cucullaea corioensis*, McCoy; *Cardita delicatula*, Tate; *Chama lamellifera*, T. Woods; *Cardium hemimeris*, Tate; *Venus (Chione) cainozoicus*, T. Woods sp.; *Corbula pyxidata*,

3. Proc. Roy. Soc. Vict., Vol. xiv. (N.S.), pt. i., 1901, p. 44.

4. The Landslip Point Fossils were later shown to be of Janjukian or Miocene age. See Chapman, Mem. Nat. Mus., Melbourne, No. 5, 1914, pp. 29, 30.

5. Proc. R. Soc. Vict., Vol. xiv. (N.S.), pt. i., 1901, pp. 46-53, The nomenclature is here corrected to date.



Tate; *Argobuccinum pratti*, Tate sp.; *Lotorium tortirostre*, Tate sp.; *Nassa tatei*, T. Woods; *Lyria harpularia*, Tate; *Marginella propinqua*, Tate; *M. wentworthi*, T. Woods; *Turris* (?) *trilirata*, Harris sp.; *Bathytoma rhomboidalis*, T. Woods sp.; *Bela* (*Daphnobela*) *gracillima*, T. Woods sp.; *Conus cuspidatus*, Tate; *Cypraea subpyrulata*, Tate; *Trivia avellanoides*, McCoy; *Natica hamiltonensis*, T. Woods; *Solarium acutum*, T. Woods; *Turritella murrayana*, Tate; *Siliquaria occlusa*, T. Woods sp.; *Scaphander tenuis*, Harris; *Vaginella eligmostoma*, Tate; *Dentalium aratum*, Tate.

The above list does not seem to include any species which are distinctive of either Balcombian or Janjukian, for they all have an extensive geological range.<sup>6</sup>

A further suite of fossils was recorded from the ironstone band at Landslip Point by the present writer in 1914,<sup>7</sup> the result of an extended search made by Mr. R. A. Keble and himself. These fossils are:—

*Placotrochus* sp.; *Sphenotrochus emarciatus*, Duncan; *Ditrupa cornea*, L. sp., var. *wormbetiensis*, McCoy; *Terebratula* (?) *aldingae*, Tate; *Magellania garibaldiana*, Davidson sp.; *Pecten foulcheri*, T. Woods; *P.* cf. *flindersi*, Tate; *P. praecursor*, Chapman; *Limatula* sp.; *Cuspidaria subrostrata*, Tate; *Dentalium mantelli*, Zittel; *Latirus* (?) *acstinostephes*, Tate sp.; *Oliva* sp.; *Columbarium acanthostephes*, Tate sp.

Among the above fossils, *Ditrupa cornea*, var. *wormbetiensis* is especially typical of Janjukian beds. *Terebratula aldingae* is a restricted Janjukian form, as are also *Pecten praecursor* and *P. flindersi*.

The writer has also (loc. supra cit.) compared these ferruginous gravels with the "older gold drifts" in Western Victoria, where, at Stawell,<sup>8</sup> they contain a fairly extensive series of Janjukian marine fossils.

6. See F. Chapman, Mem. Nat. Mus. Melbourne, No. 5, 1914, p. 29, par. 3.

7. Loc. supra cit., pp. 29, 30.

8. Vict. Naturalist, Vol. xxi., 1905, pp. 178-180.

### Further Evidence of the Miocene Age of the Ferruginous Deposits.

A few months ago my friend, Mr. J. H. Young, of Meredith, who is already known as an enthusiastic and successful collector of fossils, paid a visit to Watson's Creek, near the intersection of the Pearcedale and Somerville Roads, half a mile west of Baxter railway station. He there found an ironstone band crossing the creek, which contained fossil casts. Several clearly identifiable specimens of *Pecten praecursor* were found there, a species which is typical of the Janjukian. The matrix in which the fossils occur is a fine-grained ironstone, with small patches of limonite, minute flakes of micaceous iron-ore, and also small, numerous wind-polished quartz grains scattered throughout. Besides the Pectens there are numbers of small fragments of polyzoa present, but indeterminable. These polyzoa are in such abundance as to lead one to infer that the ironstone is largely a replacement of a limestone comparable with the polyzoal rock of Batesford and Grange Burn. This replacement at a later stage, of calcareous by limonitic material seems precisely similar to what has happened in some of the "Gold Drifts" as at Stawell, referred to above, which are to some extent re-sorted or remanié beds, the same characters being also borne by certain of the ferruginous beds of the Mornington Peninsula.

### Conclusions.

(1) The lower part of the ferruginous series of sandstone and fossiliferous ironstone on the Mornington Peninsula from Frankston southwards is without doubt of Janjukian (Miocene) age.

(2) The fossiliferous ironstone appears to have originated from a more decidedly calcareous rock, and in some cases equivalent to a polyzoal limestone in its included fossils and original chemical composition.

(3) The change from limestone to ironstone has in some cases been brought about by a percolation of dissolved carbonate of iron, causing an interchange of bases, the replaced carbonate of iron afterwards becoming oxidised.